3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by Shaw at the Range 30 Firing Line Area, including UXO avoidance activities, environmental sampling and analysis, and groundwater monitoring well installation activities.

3.1 UXO Avoidance

UXO avoidance was performed at the Range 30 Firing Line Area following methodology outlined in the SAP. Shaw UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcel prior to site access. After the site was cleared for access, sample locations were monitored by UXO personnel following procedures outlined in the SAP.

3.2 Environmental Sampling

Environmental sampling performed during the SI at the Range 30 Firing Line Area included collection of surface and depositional soil samples, subsurface soil samples, surface water/sediment samples, and groundwater samples for chemical analysis. Sample locations were determined by observing site physical characteristics during a site walk and by reviewing historical documents and aerial photographs pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4.

3.2.1 Surface and Depositional Soil Sampling

Surface soil samples were collected from 39 locations and a depositional soil sample was collected from one location at the Range 30 Firing Line Area as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and analytical parameters are listed in Table 3-2. Soil sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Surface soil samples were collected from the uppermost foot of soil using either a direct-push technology (DPT) sampling system or a stainless-steel hand auger, following methodology specified in the SAP. The depositional soil sample was collected from the upper 0.5-foot of soil using a stainless-steel spoon. Surface and depositional soil samples were collected by first removing surface debris (e.g., rocks and vegetation) from the immediate sample area. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with procedures outlined in the SAP. As necessary, the sample

Table 3-1

Sampling Locations and Rationale
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-88Q-MW01	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected just south of Falcon Road, in an area of heavy use identified on aerial photographs, to determine if potential site-specific chemicals have impacted site media.
HR-88Q-MW02	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected in the south-central portion of Parcel 88Q, in the area of a berm identified on aerial photographs, to determine if potential site-specific chemicals have impacted site media.
HR-88Q-MW03	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected in the central portion of Parcel 88Q, in the area of a berm identified on aerial photographs, to determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP01	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the southwestern portion of the area of investigation, in an area of heavy use identified on aerial photographs, to determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP02	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the southwestern portion of the area of investigation, in the area of a berm identified on aerial photographs, to determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP03	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the western portion of the area of investigation, in the area of a berm identified on aerial photographs, to determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP04	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the western portion of the area of investigation, from a disturbed area identified on aerial photographs, to determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP05	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected from the western portion of the area of investigation within the firing line for Parcel 88Q. This sample location was selected because it is in an area with mounds and depressions identified during the site walk in October 2001. These samples were collected from one of the mounds in this area. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP06	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the north-central portion of the area of investigation within the firing lining for Parcel 88Q. This sample location was selected because review of aerial photographs showed the area to be heavily used. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP07	Surface soil	A surface soil sample was collected in the north-central portion of the area of investigation within the firing lining for Parcel 88Q. The sample was collected from within an area of three small mounds identified during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.

Table 3-1

Sampling Locations and Rationale
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-88Q-GP08	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the eastern portion of the area of investigation within a disturbed area identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP09	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the eastern portion of the area of investigation. These sample locations were selected as the area was seen to be significantly disturbed from aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP10	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the east-central portion of the area of investigation downslope from mounds discovered during the site walk. This sample location was also selected because the area was seen to be significantly disturbed from aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP11	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the eastern portion of the area of investigation, in the area of a mound discovered during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP12	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the eastern portion of the area of investigation within an area of mounds, depressions, and miscellaneous debris discovered during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP13	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the southeastern portion of the area of investigation from a berm identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP14	Surface Soil	A surface soil sample was collected in the eastern portion of the area of investigation, from a small mound identified during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP15	Surface Soil	A surface soil sample was collected in the eastern portion of the area of investigation, from a small mound identified during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP16	Surface soil and Subsurface soil	Surface soil and subsurface soil samples were collected in the central portion of the area of investigation from a berm identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP17	Surface soil and Subsurface soil	Surface soil and subsurface soil samples were collected in the central portion of the area of investigation within the firing line for Parcel 88Q from a berm identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.

Table 3-1

Sampling Locations and Rationale
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-88Q-GP18	Surface Soil	A surface soil sample was collected in the east-central portion of the area of investigation, within a small depression identified during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP19	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected along the western boundary of the area of investigation, in an area identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP20	Surface soil	A surface soil sample was collected in the west-central portion of the area of investigation within the firing lining for Parcel 88Q. The sample was collected from within a depression identified during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP21	Surface soil	A surface soil sample was collected in the central portion of the area of investigation within the firing lining for Parcel 88Q. The sample was collected from within a depression identified during the site walk. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP22	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected south of Falcon Road within Parcel 88Q from a disturbed area identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP23	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected south of Falcon Road within Parcel 88Q from a disturbed area identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP24	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected south of Falcon Road within Parcel 88Q from a disturbed area identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-GP25	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected south of Falcon Road within Parcel 88Q from a disturbed area identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-SW/SD01	Surface water and Sediment	Surface water and sediment samples were collected upstream of the area of investigation from a surface water drainage feature along the north and eastern boundary of the area of investigation. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-88Q-SW/SD02	Surface water and Sediment	Surface water and sediment samples were collected from a surface water drainage feature along the northeastern boundary of the area of investigation just within the firing line for Parcel 88Q. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-102Q-MW01	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected downgradient of the firing line for the Former Rifle/Machine Gun Range, Parcel 102Q. Sample data will determine if potential site-specific chemicals have impacted site media.

Table 3-1

Sampling Locations and Rationale
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-102Q-GP01	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected south of Falcon Road within Parcel 102Q from a disturbed area identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-102Q-GP02	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected south of Falcon Road within Parcel 102Q from the firing line area identified in the Archives Search Report (ASR). Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-MW01	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected in the northern portion of the area of investigation in an area identified in the ASR as the Hand Grenade Court (OA-15). The samples are located downgradient of several berms and in an area of heavy use. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-GP01	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the northwestern portion of the area of investigation and within Parcel 106Q-X. This sample location was selected because it is within an area where several berms were identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-GP02	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the northern portion of the area of investigation and within Parcel 106Q-X. This sample location was selected because it is within an area where several berms were identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-GP03	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the west-central portion of the area of investigation within Parcel 106Q-X. This sample location was selected because a berm was identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-GP04	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the northern portion of the area of investigation and within Parcel 106Q-X. This sample location was selected because it is within an area where several historical berms were identified from aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-GP05	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected near the northern boundary of the area of investigation within a historically disturbed area identified from aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-GP06	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the northern portion of the area of investigation (within Parcel 106Q-X) in the area of a large berm identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-GP07	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the western portion of the area of investigation (within Parcel 106Q-X) in the area of a large berm identified on aerial photographs. Sample data will determine if potential site-specific chemicals have impacted site media.
HR-106Q-DEP01	Depositional Soil	The depositional soil sample was collected downslope of the area of investigation from a dry surface water drainage north of the area of investigation. Sample data will determine if potential site-specific chemicals have impacted site media.

Table 3-2

Soil Sample Designations and Analytical Parameters
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples: Field Duplicates	QA/QC Samples: MS/MSD	Analytical Parameters
HR-88Q-GP01	HR-88Q-GP01-SS-PQ0001-REG HR-88Q-GP01-DS-PQ0002-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP02	HR-88Q-GP02-SS-PQ0003-REG HR-88Q-GP02-DS-PQ0004-REG	0-1 3-4	HR-88Q-GP02-DS-PQ0005-FD		Metals and Explosives
HR-88Q-GP03	HR-88Q-GP03-SS-PQ0006-REG HR-88Q-GP03-DS-PQ0007-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP04	HR-88Q-GP04-SS-PQ0008-REG HR-88Q-GP04-DS-PQ0009-REG	0-1 3-4			Metals, Explosives, VOCs, SVOCs, Pesticides, and Herbicides
HR-88Q-GP05	HR-88Q-GP05-SS-PQ0010-REG HR-88Q-GP05-DS-PQ0011-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP06	HR-88Q-GP06-SS-PQ0012-REG HR-88Q-GP06-DS-PQ0013-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP07	HR-88Q-GP07-SS-PQ0014-REG	0-1			Metals and Explosives
HR-88Q-GP08	HR-88Q-GP08-SS-PQ0015-REG HR-88Q-GP08-DS-PQ0016-REG	0-1 3-3.5			Metals, Explosives, VOCs, SVOCs, Pesticides, and Herbicides
HR-88Q-GP09	HR-88Q-GP09-SS-PQ0017-REG HR-88Q-GP09-DS-PQ0018-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP10	HR-88Q-GP10-SS-PQ0019-REG HR-88Q-GP10-DS-PQ0021-REG	0-1 3-4	HR-88Q-GP10-SS-PQ0020-FD		Metals and Explosives
HR-88Q-GP11	HR-88Q-GP11-SS-PQ0022-REG HR-88Q-GP11-DS-PQ0023-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP12	HR-88Q-GP12-SS-PQ0024-REG HR-88Q-GP12-DS-PQ0025-REG	0-1 3-4			Metals, Explosives, VOCs SVOCs, Pesticides, and Herbicides
HR-88Q-GP13	HR-88Q-GP13-SS-PQ0026-REG HR-88Q-GP13-DS-PQ0028-REG	0-1 3-4	HR-88Q-GP13-SS-PQ0027-FD		Metals and Explosives
HR-88Q-GP14	HR-88Q-GP14-SS-PQ0029-REG	0-1			Metals and Explosives
HR-88Q-GP15	HR-88Q-GP15-SS-PQ0030-REG	0-1	HR-88Q-GP15-SS-PQ0031-FD		Metals and Explosives
HR-88Q-GP16	HR-88Q-GP16-SS-PQ0032-REG HR-88Q-GP16-DS-PQ0033-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP17	HR-88Q-GP17-SS-PQ0034-REG HR-88Q-GP17-DS-PQ0035-REG	0-1 3-4		HR-88Q-GP17-DS-PQ0035-MS/MSD	Metals, Explosives, VOCs SVOCs, Pesticides, and Herbicides

Table 3-2

Soil Sample Designations and Analytical Parameters
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples: Field Duplicates	QA/QC Samples: MS/MSD	Analytical Parameters
HR-88Q-GP18	HR-88Q-GP18-SS-PQ0036-REG	0-1			Metals and Explosives
HR-88Q-GP19	HR-88Q-GP19-SS-PQ0037-REG HR-88Q-GP19-DS-PQ0038-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP20	HR-88Q-GP20-SS-PQ0039-REG	0-1			Metals and Explosives
HR-88Q-GP21	HR-88Q-GP21-SS-PQ0040-REG	0-1			Metals and Explosives
HR-88Q-GP22	HR-88Q-GP22-SS-PQ0041-REG HR-88Q-GP22-DS-PQ0042-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP23	HR-88Q-GP23-SS-PQ0043-REG HR-88Q-GP23-DS-PQ0044-REG	0-1 3-4	HR-88Q-GP23-DS-PQ0045-FD		Metals and Explosives
HR-88Q-GP24	HR-88Q-GP24-SS-PQ0046-REG HR-88Q-GP24-DS-PQ0047-REG	0-1 3-4			Metals and Explosives
HR-88Q-GP25	HR-88Q-GP25-SS-PQ0048-REG HR-88Q-GP25-DS-PQ0049-REG	0-1 3-4			Metals and Explosives
HR-88Q-MW01	HR-88Q-MW01-SS-PQ0050-REG HR-88Q-MW01-DS-PQ0051-REG	0-1 3-4		HR-88Q-MW01-SS-PQ0050-MS/MSD	Metals, Explosives, VOCs SVOCs, Pesticides, and Herbicides
HR-88Q-MW02	HR-88Q-MW02-SS-PQ0052-REG HR-88Q-MW02-DS-PQ0053-REG	0-1 3-4		HR-88Q-MW02-SS-PQ0052-MS/MSD	Metals and Explosives
HR-88Q-MW03	HR-88Q-MW03-SS-PQ0054-REG HR-88Q-MW03-DS-PQ0055-REG	0-1 3-4	HR-88Q-MW03-DS-PQ0056-FD		Metals and Explosives
HR-102Q-GP01	HR-102Q-GP01-SS-QF0001-REG HR-102Q-GP01-DS-QF0002-REG	0-1 3-4		HR-102Q-GP01-SS-QF0001-MS/MSD	Metals and Explosives
HR-102Q-GP02	HR-102Q-GP02-SS-QF0003-REG HR-102Q-GP02-DS-QF0004-REG	0-1 2.5-3			Metals and Explosives
HR-102Q-MW01	HR-102Q-MW01-SS-QF0005-REG HR-102Q-MW01-DS-QF0006-REG	0-1 3-4			Metals and Explosives
HR-106Q-GP01	HR-106Q-GP01-SS-PR0001-REG HR-106Q-GP01-DS-PR0002-REG	0-1 3-4			Metals and Explosives
HR-106Q-GP02	HR-106Q-GP02-SS-PR0003-REG HR-106Q-GP02-DS-PQ0005-REG	0-1 3-4	HR-106Q-GP02-SS-PR0004-FD		Metals, Explosives, VOCs SVOCs, Pesticides, and Herbicides
HR-106Q-GP03	HR-106Q-GP03-SS-PR0006-REG HR-106Q-GP03-DS-PR0008-REG	0-1 3-4	HR-106Q-GP03-SS-PR0007-FD		Metals and Explosives

Table 3-2

Soil Sample Designations and Analytical Parameters
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples: Field Duplicates	QA/QC Samples: MS/MSD	Analytical Parameters
HR-106Q-GP04	HR-106Q-GP04-SS-PR0009-REG	0-1			Metals and Explosives
	HR-106Q-GP04-DS-PR0010-REG	3-4			
HR-106Q-GP05	HR-106Q-GP05-SS-PR0011-REG	0-1			Metals and Explosives
	HR-106Q-GP05-DS-PR0012-REG	3-4			
HR-106Q-GP06	HR-106Q-GP06-SS-PR0013-REG	0-1			Metals and Explosives
	HR-106Q-GP06-DS-PR0014-REG	3-4			
HR-106Q-GP07	HR-106Q-GP07-SS-PR0015-REG	0-1			Metals and Explosives
	HR-106Q-GP07-DS-PR0016-REG	3-4			
HR-106Q-MW01	HR-106Q-MW01-SS-PR0017-REG	0-1			Metals and Explosives
	HR-106Q-MW01-DS-PR0018-REG	3-4			
HR-106Q-DEP01	HR-106Q-DEP01-DEP-PR0019-REG	0-1		HR-106Q-DEP01-DEP-PR0019-MS/MSD	Metals and Explosives

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

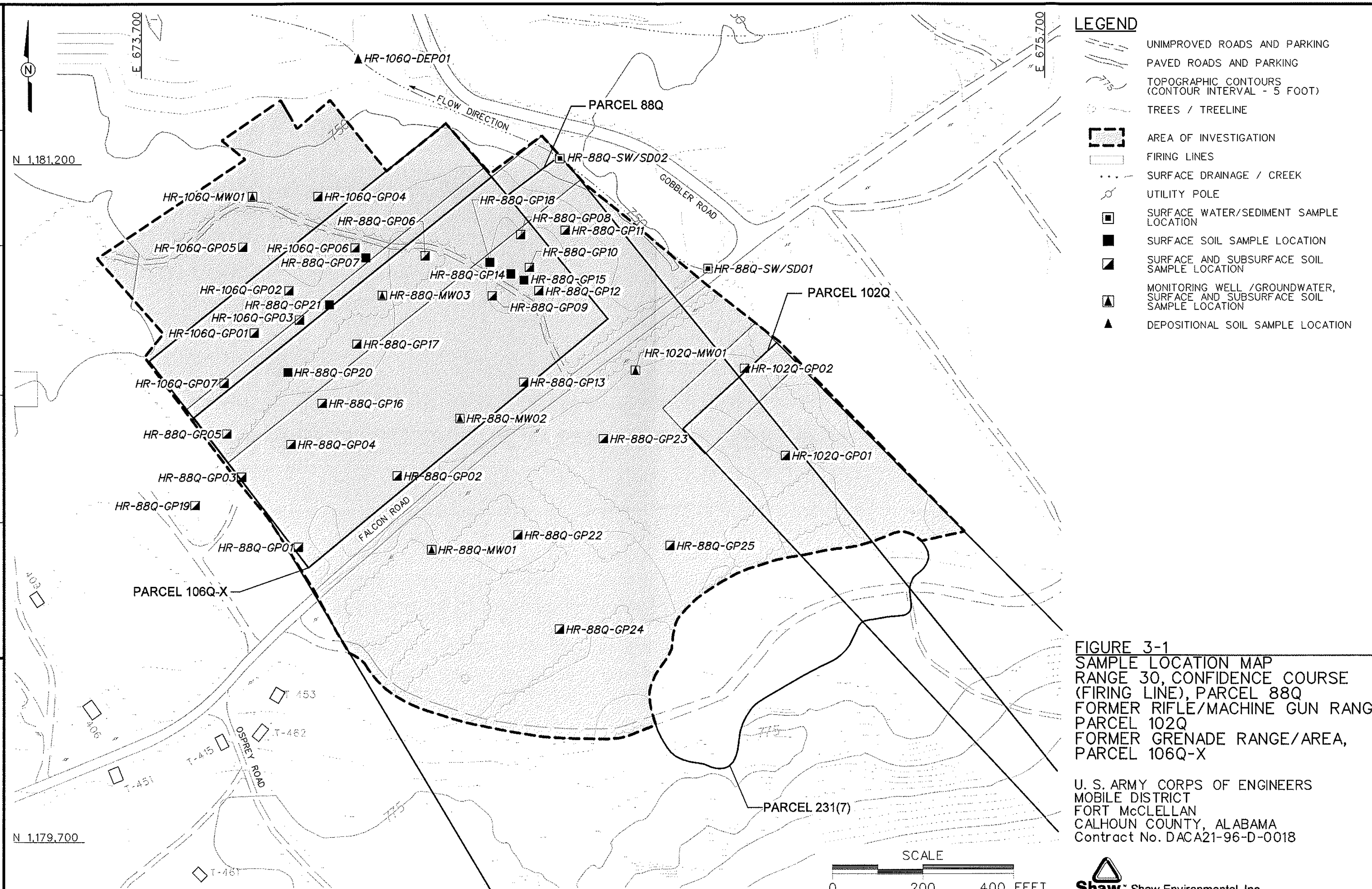


FIGURE 3-1
SAMPLE LOCATION MAP
RANGE 30, CONFIDENCE COURSE (FIRING LINE), PARCEL 88Q
FORMER RIFLE/MACHINE GUN RANGE, PARCEL 102Q
FORMER GRENADE RANGE/AREA, PARCEL 106Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw Environmental, Inc.

DWG NO.: ..\796887es449
PROJ. NO.: 796887
INITIATOR: D. ALLAN
PROJ MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 05/15/02
DRAWN BY: D. BOMAR

fraction for volatile organic compound (VOC) analysis was collected directly from the sampling device using three EnCore samplers. The remaining soil was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from 33 soil borings at the Range 30 Firing Line Area as shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Sample designations, depths, and analytical parameters are listed in Table 3-2. Soil boring locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Subsurface soil samples were collected from soil borings at a depth of 3 to 4 feet below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and soil samples collected using either a DPT sampling system or a stainless-steel hand auger, following the procedures specified in the SAP. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected continuously to 4 feet bgs or until DPT sampler or hand auger refusal was encountered. Samples were field screened using a PID to measure volatile organic vapors in accordance with procedures outlined in the SAP. The sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were below background, the deepest sample interval above the saturated zone was submitted for analysis. As necessary, the sample fraction for VOC analysis was collected directly from the sampling device using three EnCore samplers. The remaining soil was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The on-site geologist constructed a detailed boring log for each soil boring. The boring logs are included in Appendix B. At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in the SAP.

3.2.3 Monitoring Well Installation

Five permanent groundwater monitoring wells were installed in the saturated zone at the Range 30 Firing Line Area to collect groundwater samples for laboratory analysis. The well locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the monitoring wells installed at the site. The well construction logs are included in Appendix B.

Shaw contracted Miller Drilling Company to install the permanent wells using a hollow-stem auger drill rig at five of the DPT/hand auger soil boring locations (HR-88Q-MW01, HR-88Q-MW02, HR-88Q-MW03, HR-102Q-MW01, and HR-106Q-MW01). The wells were installed following procedures outlined in the SAP. The borehole at each well location was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the saturated zone. The borehole was augered to the completion depth of the soil boring, and soil samples were collected at that depth to the bottom of the borehole. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. The samples were logged to determine lithological changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geological and hydrogeological information. Soil characteristics were described using the "Burmeister Identification System" described in Hunt (1986) and the Unified Soil Classification System as outlined in American Society for Testing and Materials (ASTM) Method D 2488 (ASTM, 2000). The boring logs are included in Appendix B.

Upon reaching the target depth in each borehole, a 15- or 20-foot length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with a PVC end cap was placed through the auger to the bottom of the borehole. The screen and end cap were attached to 2-inch ID, flush-threaded Schedule 40 PVC riser. A filter pack consisting of Number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 3 feet above the top of the well screen as the augers were removed. The filter pack at HR-88Q-MW01 also included a 5-foot layer of extra fine filter sand (sieve size 30 to 60). The well was surged using a solid PVC surge block for approximately 10 minutes or until no more settling of the filter sand occurred. A bentonite seal, consisting of approximately 3 feet of bentonite pellets, was placed immediately on top of the filter sand and hydrated with potable water. Bentonite seal placement and hydration followed procedures in the SAP. Bentonite-cement grout was tremied into the remaining annular space of the well from the top of the bentonite seal to the ground surface. A locking protective steel casing was placed over the PVC well riser and a concrete pad was constructed around the wellhead. Four protective steel posts were installed around the well pad. A locking well cap was placed on the PVC well riser.

The monitoring wells were developed by surging and pumping with a submersible pump in accordance with methodology outlined in the SAP. The submersible pump used for well

Table 3-3

Monitoring Well Construction Summary
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Well Location	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)	Well Material
HR-88Q-MW01	1180343.25	674343.92	764.76	766.83	66	20	46 - 66	2" ID Sch. 40 PVC
HR-88Q-MW02	1180634.06	674406.87	762.62	764.68	43	15	28 - 43	2" ID Sch. 40 PVC
HR-88Q-MW03	1180905.90	674235.20	759.76	761.71	49.2	20	29.2 - 49.2	2" ID Sch. 40 PVC
HR-102Q-MW01	1180740.44	674796.08	764.28	766.32	39	20	19 - 39	2" ID Sch. 40 PVC
HR-106Q-MW01	1181125.30	673948.38	760.73	762.86	35	15	20 - 35	2" ID Sch. 40 PVC

Permanent wells installed using hollow-stem auger.
Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983.
Elevations referenced to the North American Vertical Datum of 1988.
2" ID Sch. 40 PVC - 2-inch inside diameter, Schedule 40, polyvinyl chloride.
amsl - Above mean sea level.
bgs - Below ground surface.
ft - Feet.

development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well to re-establish the natural hydraulic flow conditions. Development continued until the water turbidity was equal to or less than 20 nephelometric turbidity units (NTU), or for a maximum of 8 hours. The well development logs are included in Appendix C.

3.2.4 Water Level Measurements

The depth to groundwater was measured in the permanent wells at the site on July 26, 2002, following procedures outlined in the SAP. Depth to groundwater was measured with an electronic water-level meter. The meter probe and cable were cleaned before use at each well following decontamination methodology presented in the SAP. Measurements were referenced to the top of the PVC well casing, as summarized in Table 3-4.

3.2.5 Groundwater Sampling

Groundwater samples were collected from each of the five permanent monitoring wells installed at the Range 30 Firing Line Area. The well/groundwater sample locations are shown on Figure 3-1. The groundwater sampling locations and rationale are listed in Table 3-1. The groundwater sample designations and analytical parameters are listed in Table 3-5.

Sample Collection. Groundwater samples were collected using a bladder pump equipped with Teflon™ tubing, following the procedures outlined in the SAP. Groundwater was sampled after purging a minimum of three well volumes and after field parameters (temperature, pH, dissolved oxygen, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. At one sample location (HR-106Q-MW01), the turbidity remained moderately elevated (95 NTUs). Therefore, the sample fraction for metals analysis was collected, allowed to settle, and then decanted prior to shipment to the laboratory for analysis. Field parameters were measured using a calibrated water-quality meter. Field parameter readings are summarized in Table 3-6. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.4.

3.2.6 Surface Water Sampling

Two surface water samples were collected at the Range 30 Firing Line Area at the locations shown on Figure 3-1. The surface water sample designations and analytical parameters are listed in Table 3-7. The actual sampling locations were determined in the field, based on drainage pathways and field observations.

Table 3-4

Groundwater Elevations
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)
HR-88Q-MW01	26-Jul-02	34.88	766.83	764.76	731.95
HR-88Q-MW02	26-Jul-02	36.55	764.68	762.62	728.13
HR-88Q-MW03	26-Jul-02	33.18	761.71	759.76	728.53
HR-102Q-MW01	26-Jul-02	37.10	766.32	764.28	729.22
HR-106Q-MW01	26-Jul-02	34.83	762.86	760.73	728.03

Elevations referenced to the North American Vertical Datum of 1988.
amsl - Above mean sea level.
BTOC - Below top of casing.
ft - Feet.

Table 3-5

Groundwater Sample Designations and Analytical Parameters
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	QA/QC Samples		Analytical Parameters
		Field Duplicates	MS/MSD	
HR-88Q-MW01	HR-88Q-MW01-GW-PQ3001-REG			Metals and Explosives
HR-88Q-MW02	HR-88Q-MW02-GW-PQ3002-REG		HR-88Q-MW02-GW-PQ3002-MS/MSD	Metals and Explosives
HR-88Q-MW03	HR-88Q-MW03-GW-PQ3003-REG			Metals and Explosives
HR-102Q-MW01	HR-102Q-MW01-GW-QF3001-REG			Metals and Explosives
HR-106Q-MW04	HR-106Q-MW01-GW-PR3001-REG	HR-106Q-MW01-GW-PR3002-FD		Metals, VOCs, SVOCs, Explosives, Pesticides, and Herbicides

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

Table 3-6

Groundwater and Surface Water Field Parameters
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Date	Sample Media	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTU)	pH (SU)
HR-88Q-MW01	27-Mar-02	GW	0.154	7.48	235	13.6	6.1	5.74
HR-88Q-MW02	18-Mar-02	GW	0.331	14.13*	185	18.7	19	6.94
HR-88Q-MW03	15-Mar-02	GW	0.032	12.99*	275	18.6	4.3	5.19
HR-88Q-SW/SD01	12-Mar-02	SW	0.230	11.30	385	11.5	462	5.33
HR-88Q-SW/SD02	12-Mar-02	SW	0.180	10.45	305	11.4	144	5.77
HR-102Q-MW01	25-Mar-02	GW	0.043	18.32*	270	22.0	6.3	4.75
HR-106Q-MW01	19-Mar-02	GW	0.372	16.19*	205	20.4	95	6.95

* Result artificially elevated due to air in sampling equipment.

°C - Degree Celsius.
GW - Groundwater.
mg/L - Milligram per liter.
mS/cm - Millisiemen per centimeter.
mV - Millivolt.
NTU - Nephelometric turbidity unit.
ORP - Oxidation-reduction potential.
SU - Standard unit.
SW - Surface water.

Table 3-7

Surface Water and Sediment Sample Designations and Analytical Parameters
Range 30 Firing Line Area, Parcels 88Q, 102Q, and 106Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Matrix	QA/QC Samples		Analytical Parameters
			Field Duplicates	MS/MSD	
HR-88Q-SW/SD01	HR-88Q-SW/SD01-SW-PQ2001-REG HR-88Q-SW/SD01-SD-PQ1001-REG	Surface Water Sediment	HR-88Q-SW/SD01-SW-PQ2002-FD HR-88Q-SW/SD01-SD-PQ1002-FD		Metals, Explosives, TOC, and Grain Size (sediment only)
HR-88Q-SW/SD02	HR-88Q-SW/SD02-SW-PQ2003-REG HR-88Q-SW/SD02-SD-PQ1003-REG	Surface Water Sediment			Metals, Explosives, VOCs, SVOCs, Pesticides, and Herbicides TOC & Grain Size (sediment only)

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
REG - Field sample.
SVOCs - Semivolatile organic compound.
TOC - Total organic carbon.
VOC - Volatile organic compound.

Sample Collection. The surface water samples were collected in accordance with the procedures specified in the SAP. The surface water samples were collected by dipping a stainless-steel pitcher into the water and pouring the water into the sample containers. The surface water samples were collected after field parameters had been measured using a calibrated water quality meter. Surface water field parameters are listed in Table 3-6. The sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-7 using methods outlined in Section 3.4.

3.2.7 Sediment Sampling

Two sediment samples were collected at the same locations as the surface water samples, as shown on Figure 3-1. The sediment sampling locations and rationale are presented in Table 3-1. The sediment sample designations and analytical parameters are listed in Table 3-7. The actual sediment sampling locations were determined in the field, based on drainage pathways and field observations.

Sample Collection. The sediment samples were collected in accordance with the procedures specified in the SAP. Sediments were collected with a stainless-steel hand auger and placed in a stainless-steel bowl. As necessary, the sediment fraction for VOC analysis was collected directly from the bowl using three EnCore samplers. The remaining sediment was homogenized and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The sediment samples were analyzed for the parameters listed in Table 3-7 using methods outlined in Section 3.4.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey techniques and conventional civil survey techniques described in the SAP. Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at the Range 30 Firing Line Area were analyzed for the following parameters using EPA SW-846 methods, including Update III methods where applicable:

- Target analyte list metals – EPA Method 6010B/7000
- Nitroaromatic and nitramine explosives – EPA Method 8330.

A minimum of ten percent of the samples were analyzed for the following additional parameters:

- Target compound list (TCL) VOCs – EPA Method 8260B
- TCL semivolatile organic compounds (SVOC) – EPA Method 8270C
- Chlorinated pesticides – EPA Method 8081A
- Chlorinated herbicides – EPA Method 8151A
- Organophosphorous pesticides – EPA Method 8141A.

Sediment samples were also analyzed for the following parameters:

- Total organic carbon – EPA Method 9060
- Grain size – American Society of Testing and Materials Method D-422.

3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in the SAP. Sample documentation and chain-of-custody records were completed as specified in the SAP.

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to EMAX Laboratories, Inc. in Torrance, California.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in the SAP. The IDW generated during the SI at the Range 30 Firing Line Area was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities and decontamination fluids
- Spent well materials and personal protective equipment.

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analysis. Based on the results, drill cuttings, spent well materials, and personal protective equipment generated during the SI were disposed as nonhazardous waste at the Three Corners Landfill in Piedmont, Alabama.

Liquid IDW was contained in the 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonhazardous waste to the FTMC wastewater treatment plant on the Main Post.

3.7 Variances/Nonconformances

One variance to the SFSP was recorded during completion of the SI at the Range 30 Firing Line Area. Surface water and sediment samples were not collected at proposed location HR-106Q-SW/SD01 because surface water and sediment were not present in the drainage feature at the time of sample collection. Therefore, a depositional soil sample (HR-106Q-DEP01) was collected at this location. The variance did not alter the intent of the investigation or the sampling rationale presented in the SFSP. The variance report is included in Appendix E.

No nonconformances were recorded during completion of the SI.

3.8 Data Quality

The field sample analytical data are presented in tabular form in Appendix F. The field samples were collected, documented, handled, analyzed and reported in a manner consistent with the SI work plan, the FTMC SAP and quality assurance plan, and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 2001b) and the stipulated requirements for the generation of definitive data presented in the SAP. Chemical data were reported by the laboratory via hard-copy data packages using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The data validation results are summarized in a quality assurance report, which includes the data validation summary report (Appendix G). Selected results were qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC Shaw Environmental Management System database for tracking and reporting. The qualified data were used in comparisons to the SSSLs and ESVs. Rejected data (assigned an "R" qualifier) were not used in the comparisons to the SSSLs and ESVs. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

4.0 Site Characterization

Subsurface investigations performed at the Range 30 Firing Line Area provided soil, geologic, and groundwater data used to characterize the geology and hydrogeology of the site.

4.1 Regional and Site Geology

4.1.1 Regional Geology

Calhoun County includes parts of two physiographic provinces: the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992) and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984) but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish gray siltstone and mudstone. Massive to laminated greenish gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appears to dominate the unit and consists primarily of coarse-grained, vitreous quartzite and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish gray or pale yellowish gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline, porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish red-purple mudstone, shale, siltstone, and greenish red and light gray sandstone, with locally occurring limestone and dolomite. Weaver Cave, located approximately one mile west of the northwest boundary of the Main Post, is situated in gray dolomite and limestone mapped as the Rome Formation (Osborne et al., 1997). The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark gray, finely to coarsely crystalline, medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites, and limestones and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Osborne, et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish gray to grayish red phosphatic shale, with increasing amounts of calcareous chert towards the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty clay, shale, and mudstone with interbedded light to medium gray, very fine to fine grained, argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium to dark gray, argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). The Parkwood Formation in Calhoun County is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geological feature in the vicinity of the Main Post of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama, and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or fenster, in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation; north by the Conasauga Formation; northeast, east, and southwest by the Shady Dolomite; and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the FTMC window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. Here, the trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three-quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham Range is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks and is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window and along the trace of the Pell City fault on

Pelham Range (Thomas and Neathery, 1982; Osborne et al., 1988). The Coosa deformed belt is a narrow northeast-to-southwest-trending linear zone of complex structure (approximately 5 to 20 miles wide and approximately 90 miles in length) consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

4.1.2 Site Geology

The soils within the area of investigation fall into the Cumberland gravelly loam and Anniston gravelly loam units. The Cumberland gravelly loam has generally developed in old alluvium that washed from soils derived mainly from limestone, cherty limestone, shale and sandstone. The surface soil ranges from very dark brown to reddish brown. The subsoil ranges from dark red to red, and from silt-clay loam to clay in texture. The thickness of the alluvium ranges from two to greater than 15 feet. Some areas included in this soil-mapping unit have a silt loam to gravelly fine sandy loam surface soil that is generally underlain in places by beds of gravel or sand. Rounded chert, sandstone and quartz gravel, as much as 3 inches in diameter can be found throughout the soil. Infiltration of this soil type is medium, permeability moderate, and the capacity for available moisture is high (U.S. Department of Agriculture [USDA], 1961).

The Anniston gravelly clay loam consists of friable, medium to strongly acidic, deep, well-drained soils that have developed in old alluvium on the foot slopes and along the base of larger hills in the region. The parent material is washed from the adjacent, higher-lying Linker, Muskingham, Enders and Montevallo Soils, which developed from weathered sandstone, shale and quartzite. Sandstone and quartzite gravel, cobbles and fragments as much as 8 inches in diameter are on the surface and throughout the soil. The color of the surface soil ranges from dark brown and very dark brown to reddish brown and dark reddish brown. The texture of the subsoil ranges from light clay loam to clay or silty clay loam. The alluvium ranges in thickness from 2 feet to more than 8 feet. Infiltration and runoff are medium, permeability is moderate and the capacity for available moisture is high. Organic matter is moderately low (USDA, 1961).

Bedrock underlying the area of investigation is mapped as the Cambrian Conasauga Formation (Osborne et al., 1997). This unit is composed of dark gray, finely to coarsely crystalline, medium to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

The residuum encountered during drilling activities at the site was a light brown to reddish yellow-orange clay with varying amounts of silt, sand, and quartz-rich gravel. Auger refusal was encountered during the drilling of monitoring wells HR-88Q-MW01, HR-88Q-MW02, and HR-106Q-MW01 at depths of 66, 43, and 35.4 feet bgs, respectively. Refusal was encountered in a gray, highly weathered sand and gravel, which reacted weakly with dilute hydrochloric acid, and is therefore assumed to be highly weathered dolomite.

4.2 Site Hydrology

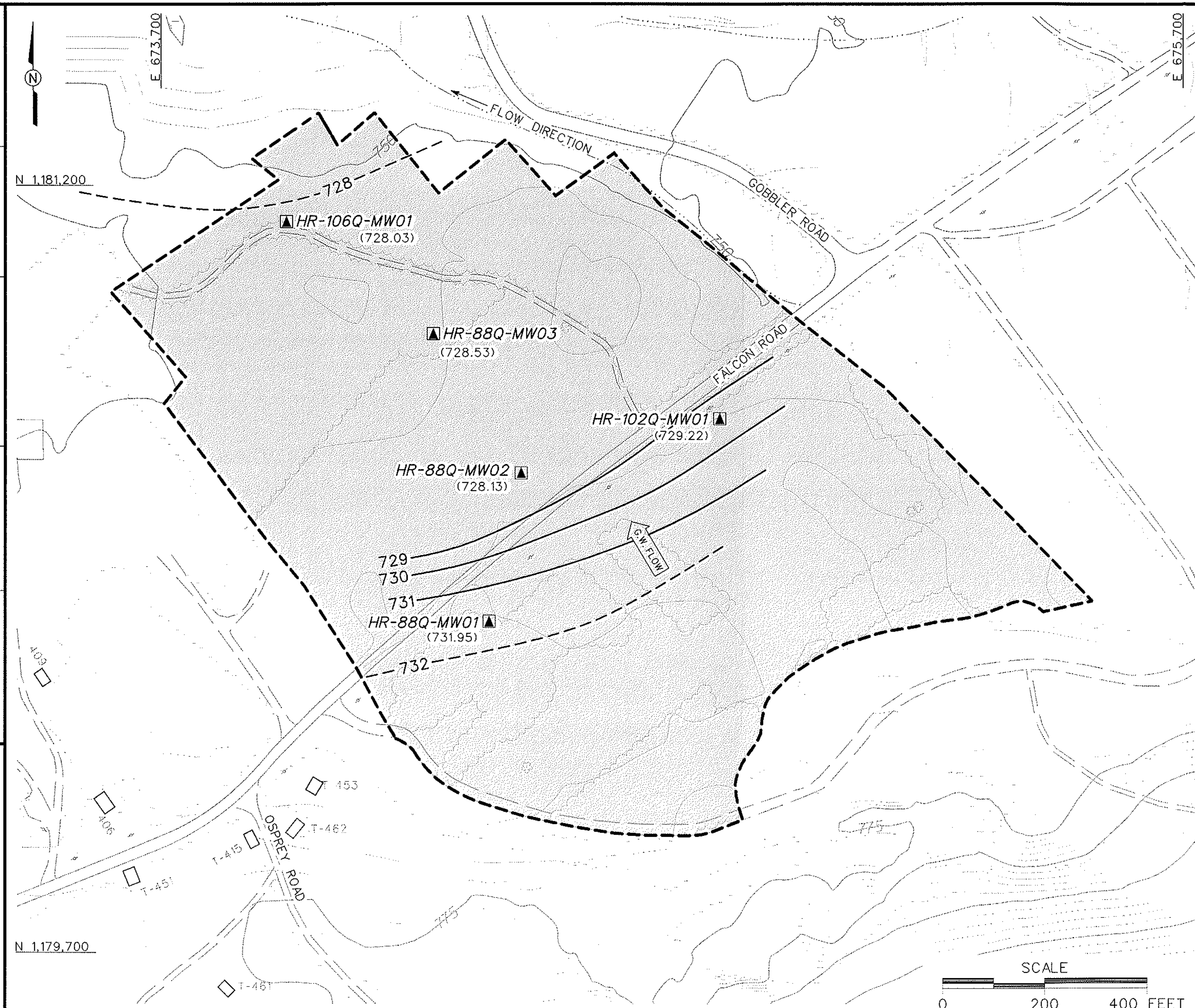
4.2.1 Surface Hydrology

Precipitation in the form of rainfall averages about 53 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water features at the Main Post of FTMC include Remount Creek, Cane Creek, and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County.

The ground surface within the area of investigation is relatively flat with only a slight slope to the northwest. The overall elevation extends from approximately 750 to 780 feet above mean sea level. An unnamed intermittent stream flows to the northwest along the northwest corner of the area of investigation. This intermittent stream eventually empties into Reilly Lake.

4.2.2 Hydrogeology

During soil boring and well installation activities, groundwater was encountered at depths ranging from approximately 29 to 64 feet bgs at four of the monitoring well locations (Appendix B). At HR-102Q-MW01, groundwater was not encountered during drilling, but entered the well within 24 hours. Comparison of static groundwater level data collected at the site on July 26, 2002 (Table 3-4) with groundwater levels recorded during drilling indicates that the aquifer underlying the site is under semi-confined conditions. The groundwater flow direction at the site appears to be to the northwest, following topography (Figure 4-1).



LEGEND

UNIMPROVED ROADS AND PARKING
PAVED ROADS AND PARKING
TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
(728.03) GROUNDWATER ELEVATION (FT MSL) (JULY 26, 2002)
G.W. FLOW GROUNDWATER FLOW DIRECTION
TREES / TREELINE
AREA OF INVESTIGATION
SURFACE DRAINAGE / CREEK
UTILITY POLE
GROUNDWATER, SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

FIGURE 4-1
GROUNDWATER ELEVATION MAP
RANGE 30, CONFIDENCE COURSE (FIRING LINE), PARCEL 88Q
FORMER RIFLE/MACHINE GUN RANGE, PARCEL 102Q
FORMER GRENADE RANGE/AREA, PARCEL 106Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw Environmental, Inc.